

**PREAMPLIFIER**

**Model 1405**

**CANBERRA INDUSTRIES, INC.**  
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**Meriden, Connecticut 06450**

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# WARRANTY

## canberra nuclear instruments

*This equipment is warranted by Canberra to be free from defects in materials and workmanship for a period of twelve months from date of shipment, provided that the equipment has been used in a proper manner as detailed in this instruction manual. Repairs or replacement, at Canberra's option, will be made without charge at the Canberra plant during this warranty period. Except for the case of defects discovered upon initial operation, shipping expense to Canberra is to be paid by the customer; shipping expense to return the repaired equipment will be paid by Canberra.*

*Canberra reserves the right to modify its products without incurring the responsibility for modifying previously manufactured products.*

*Canberra does not assume any liability for the results of particular installations, as these circumstances are not in our control.*

### SHIPPING DAMAGE

*Shipments should be carefully examined when received for evidence of damage caused by shipping. If damage is found, notify Canberra and the carrier making delivery immediately, as the carrier is normally responsible for damage caused in shipment. Carefully preserve all documentation to establish your claim. Canberra will provide all possible assistance in damage claims.*

### REPAIRS

*Any Canberra instrument no longer in its warranty period may be returned, freight prepaid, to our factory for repair and realignment. All such work will be done at the least possible expense to the customer. All equipment thus repaired or realigned will pass through our normal preshipment checkout procedure and will meet or surpass its original specifications when returned. Return shipping expense will, in this case, also be charged to the customer.*



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**TABLE OF CONTENTS**

	<b>Page</b>
<b>1 INTRODUCTION . . . . .</b>	<b>1-1</b>
1.1 General . . . . .	1-1
1.2 Applications . . . . .	1-1
1.3 Specifications . . . . .	1-1
<b>2 INITIAL OPERATION . . . . .</b>	<b>2-1</b>
2.1 Setup . . . . .	2-1
2.2 Initial Checkout . . . . .	2-1
<b>3 MODULE OPERATION . . . . .</b>	<b>3-1</b>
3.1 Control Functions . . . . .	3-1
3.2 Input Requirements . . . . .	3-1
3.4 Output Specifications . . . . .	3-1
3.4 Power Connectors . . . . .	3-1

## SCINTILLATION PREAMPLIFIER

MODEL 1405

### SECTION 1 INTRODUCTION

#### 1.1 GENERAL

The Model 1405 Scintillation Preamplifier is a charge sensitive, all silicon transistor device which integrates the charge output signals from scintillation/photomultiplier detectors, for presentation to pulse shaping main amplifiers such as the Canberra Model 1410 or Model 1415.

The Model 1405 Preamplifier contains an operational type amplifier, whose feedback from output to input is through a capacitor. The voltage developed across this capacitor is proportional to the charge from the detector. The operational amplifier is followed by a White Emitter Follower, which has been designed to drive low impedance lines (such as RG 62/U) terminated in their characteristic impedance. The Preamplifier should be placed as close to the photomultiplier as possible to minimize stray capacitance.

#### 1.2 APPLICATIONS

The Model 1405 Scintillation Preamplifier is used primarily to convert the charge output of a photomultiplier tube to a voltage signal more suitable to the instrument performing the functions of amplification, timing, counting or pulse height analysis. The photomultiplier tube output can be taken from the anode, or last two dynodes.

The 1405 will operate successfully with a variety of detectors, such as GM tubes, gas flow counters or surface barrier detectors. However, there are other charge sensitive preamplifiers like the Model 1406 proportional counter or Model 1408A/B FET preamplifiers which may be better suited to detectors other than scintillation/photomultipliers.

The 1405 contains a White Emitter Follower which enables it to drive long lengths of cable. This makes it particularly useful in those applications where instrumentation is located long distances from the detector.

#### 1.3 SPECIFICATIONS

##### PERFORMANCE

INTEGRAL NONLINEARITY	less than 0.2% for 0 to $\pm 2.5$ volts output into 93 ohms
STABILITY	better than 0.01% per $^{\circ}\text{C}$
DETECTOR BIAS ISOLATION	3000 VDC
NOISE	less than 0.1 mV RMS at output

## SECTION 2 INITIAL OPERATION

### 2.1 SETUP

- Insert power connector cable from power source (1410, 1415, etc.) into power connector of Model 1405; turn on the power switch of Preamplifier Power Supply or AEC compatible base unit/power supply housing the amplifier from which DC power is being derived
- Connect negative input of approximately 1/2 volt from tail pulse generator into test input of Model 1405
- Connect output of Model 1405 into oscilloscope (0.5v/cm, 10 usec/cm)

### 2.2 INITIAL CHECKOUT

- Output pulse shape from the Model 1405 should appear as follows: The pulse height should be approximately 3% of the input pulse height



- Increase voltage of pulser until output from preamplifier saturates. On the oscilloscope saturation will look something like the following:



- Decrease input voltage to a point where output voltage is unsaturated
- Set oscilloscope scale on 1v/cm, 0.1 microsec/cm
- Check rise time of Model 1405 (10% and 90% points of voltage rise) to be in the order of 40 to 50 nanoseconds
- Disconnect input from pulse generator
- Test noise by taking output of Model 1405 into Canberra Model 1417 Linear Amplifier
- Set amplifier time constant to 1 microsecond. Gain controls should be at maximum settings. Input should be at POS TERM
- Connect bipolar output of 1410 to Hewlett Packard Model 400H noise meter (or comparable noise meter). The RMS noise output should be less than 0.1 millivolts RMS.

## SECTION 3 MODULE OPERATION

### 3.1 CONTROL FUNCTIONS

There are no switches or controls, as such. There are some simple internal component substitutions that can allow the tail pulse time constant or preamplifier gain to be changed. These changes must be accomplished at our factory for the warranty to remain in effect. Contact the factory for instructions.

### 3.2 INPUT REQUIREMENTS

#### SIGNAL INPUT

charge pulse from anode, or last two dynodes of scintillation/photomultiplier detector. The input is protected for up to 3000 VDC and uses an MHV connector. The 1405 should be placed as close as possible to the detector to minimize stray capacitance.

#### TEST INPUT

negative tail pulse from test pulse generator; rise time less than 100 nanoseconds; fall time greater than 50 microseconds

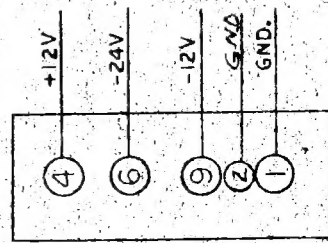
### 3.3 OUTPUT SPECIFICATIONS



#### PREAMPLIFIER OUTPUT

tail pulse, rise time less than 50 nanoseconds, 50 microseconds fall time; up to 2.5 volts before saturation at end of long terminated 93 ohm cable; output impedance 100 ohms. With unterminated cable the output saturation level will go to 4.0 volts. The output signal is inverted with respect to the charge input signal. Thus, positive high voltages will yield negative charge and a positive preamplifier signal.

### 3.4 POWER CONNECTORS

- The 1405 derives three DC supply voltages of  $\pm 12V$  and  $-24$  volts through an Amphenol Connector 17-20090. Recent versions of our amplifiers (Models 1410, 1411, 1415, 1416, and 1417) all supply proper voltages through Amphenol 17-10090 connectors located on their rear panels. Also, the Model 1409 Preamplifier Power Supply will supply the required power.
- Early versions of the 1405 received their power through AMP connector type 201597-3. Likewise, earlier versions of the Canberra Amplifiers were equipped with compatible AMP connectors.
- The new 800 Series units have always been equipped with Amphenol connectors that mate with the 800 Series preamplifiers and with newer versions of the 1400 Series.



1. ALL RESISTORS  $\frac{1}{2}$  W 5%.
2.  = FRONT PANEL.
3.  = REAR PANEL.
4. ALL RESISTOR VALUES ARE IN OHMS

POWER CONNECTOR